12. Assessment of the Dusky Rockfish Stock in the Gulf of Alaska

Kristen L. Omori and Benjamin C. Williams

November 2023

# Executive Summary

Gulf of Alaska dusky rockfish (*Sebastes variabilis*) have historically been assessed on a biennial stock assessment schedule to coincide with the availability of new trawl survey data (odd year surveys). In 2017, the Alaska Fisheries Science Center (AFSC) participated in a stock assessment prioritization process. It was recommended that the Gulf of Alaska (GOA) dusky rockfish remain on a biennial stock assessment schedule with a full stock assessment produced in even years and a harvest projection produced in odd years. The projection model is updated with new catch information and results are used to recommend harvest levels for the next two years. This incorporates the most current catch information without re-estimating model parameters and biological reference points.

The GOA dusky rockfish is classified as a Tier 3 stock and is assessed using a statistical age-structure model. This assessment consists of a population model, which uses survey and fishery data to generate a historical time series of population estimates, and a projection model, which uses results from the population model to predict future population estimates and recommended harvest levels. The data used in this assessment includes total catch biomass, fishery age and size compositions, trawl survey abundance estimates, and trawl survey age compositions.

## Summary of Changes in Assessment Inputs

*Changes in the input data:* There were no changes made to the assessment model inputs as this is an off-cycle year. New data added to the projection model included updated catch data from 2022 (3,353 t) and new estimated catches for 2023-2025. Catch data were queried on 2023-09-14. The 2023 catch was estimated by increasing the observed catch by an expansion factor of 1.179, which accounts for the average fraction of catch taken after 09-14 in the last three complete years (2020-2022). This expansion factor increased from last year’s expansion factor of 1.036 and resulted in an estimated catch for 2023 of 3,955 t. To estimate future catches, we updated the yield ratio to 0.54, which was the average ratio of catch to ABC for the last three complete catch years. This yield ratio was multiplied by the projected ABCs from the updated projection model to generate catches of 2,139 t in 2024 and 4,107 t in 2025.

## Summary of Changes in Assessment Methodology

There were no changes from the 2022 assessment (Williams *et al.* 2022) as this was an off-cycle year.

## Summary of Results

*ABC recommendation*  
The projected total biomass for 2024 is 103,625 t. The recommend ABC for 2024 is 7,593 t, the maximum allowable ABC under Tier 3a. This ABC is a -4% decrease compared to the 2023 ABC of 7,917 and a 1% increase from the projected 2024 ABC from the last year’s assessment.

The 2024 GOA-wide OFL for dusky rockfish is 9,244 t.

The stock is not being subject to overfishing, is not currently overfished, nor is it approaching a condition of being overfished.

Reference values for dusky rockfish are summarized in the following table:

|  | As estimated or *specified last* year for: | | As estimated or *recommended this* year for: | |
| --- | --- | --- | --- | --- |
| **Quantity/Status** | 2023 | 2024 | 2024\* | 2025\* |
| M (natural mortality) | 0.07 | 0.07 | 0.07 | 0.07 |
| Tier | 3a | 3a | 3a | 3a |
| Projected total (age 4+) biomass (t) | 107,160 | 104,627 | 103,625 | 102,442 |
| Projected female spawning biomass (t) | 44,651 | 44,651 | 43,185 | 41,936 |
| B100% | 65,565 | 65,565 | 65,565 | 65,565 |
| B40% | 26,226 | 26,226 | 26,226 | 26,226 |
| B35% | 22,948 | 22,948 | 22,948 | 22,948 |
| FOFL | 0.011 | 0.011 | 0.013 | 0.013 |
| *max*FABC | 0.09 | 0.09 | 0.009 | 0.009 |
| FABC | 0.09 | 0.09 | 0.009 | 0.009 |
| OFL (t) | 9,638 | 9,154 | 9,244 | 8,959 |
| *max*ABC (t) | 7,917 | 7,520 | 7,593 | 7,359 |
| ABC (t) | 7,917 | 7,520 | 7,593 | 7,359 |
|  | As determined *last* year for: | | As determined *this* year for: | |
| **Status** | 2022 | 2023 | 2023 | 2024 |
| Overfishing | No | n/a | No | n/a |
| Overfished | n/a | No | n/a | No |
| Approaching overfished | n/a | No | n/a | No |
| \*Projections are based on an estimated catch of 3,955 t for 2023 and estimates of 2,139 t and 4,107 t used in place of maximum permissible ABC for 2024 and 2025. | | | | |

## Area Apportionment

The following table shows the recommended ABC apportionment for 2024 and 2025. Please refer to the *Area Allocation of Harvests* section of last year’s assessment (Williams *et al.* 2022) for information regarding the apportionment rationale for GOA dusky rockfish.

|  | | Western | Central | Eastern | Total |
| --- | --- | --- | --- | --- | --- |
| Area Apportionment | | 1.9% | 96.6% | 1.5% | 100% |
| 2023 | ABC (t) | 144 | 7,335 | 114 | 7,593 |
| 2023 | OFL (t) |  |  |  | 9,244 |
| 2024 | ABC (t) | 140 | 7,359 | 110 | 7,359 |
| 2024 | OFL (t) |  |  |  | 8,959 |

Amendment 41 prohibited trawling in the Eastern area east of 140° W longitude. The ratio of biomass still obtainable in the W. Yakutat area (between 147° W and 140° W) is 0.74. This results in the following apportionment to the W. Yakutat area:

|  |  | W. Yakutat | E. Yakutat/Southeast |
| --- | --- | --- | --- |
| 2023 | ABC (t) | 84 | 30 |
| 2024 | ABC (t) | 81 | 29 |

## Responses to SSC and Plan Team Comments on Assessments in General

“The SSC revised and clarified the recommendation to maintain the status quo and only produce risk tables for full assessments (rather than all assessments, as indicated in the subgroup recommendation).” (SSC, June 2021)

A risk table has been included in this full assessment.

“The Team recommends all GOA authors evaluate any bottom trawl survey information used in their assessment prior to 1990 including the 1984 and 1987 surveys and conduct sensitivity analyses to evaluate their usefulness to the assessment. This may apply for Aleutian Islands surveys but this was only raised during GOA assessment considerations.” (PT, November 2021)

In recent assessments survey biomass estimates from 1984 and 1987 (note that age and size compistion data were not included) have been included in the survey biomass estimate, however those surveys used different vessels and gear and are not directly comparable to survey data from 1990+. A suite of incremental models were run to investigate the effects of removing 1980s survey data from the assessment. Therefore they have been excluded from this assessment going forward.

## Responses to SSC and Plan Team Comments Specific to this Assessment

“The SSC has also requested diagnostics to evaluate VAST model fit and suggests the author frame the discussion of these diagnostics in a species-specific manner, including consideration of the life history of the species. For example, the use of the delta-gamma observation model would seem to be appropriate for a species with patchy survey distribution. However, the implementation of this VAST-GAP recommendation resulted in a large increase in the interannual variability of the VAST survey estimates, which the SSC notes may be biologically implausible for a long-lived species such as dusky rockfish. The SSC also supports the GOA GPT recommendation to further explore the number of knots that are optimal for this species. Finally, the SSC requests that design-based estimates of survey biomass be included in comparisons with VAST model estimates.

The SSC requests the assessment author justify the use of the new parameterization of VAST specifically as it relates to dusky rockfish. Past SSC discussions regarding the general implementation of VAST in assessments precluded a highly prescriptive approach and specifically recommended allowing for some species-specific adaptations of the VAST framework (October 2020)

A suite of VAST parameterizations, associated diagnostics and design-based survey estimates have been explored and are provided as an appendix. The author’s recommended model uses a lognormal error model instead of the GAP default model.

The SSC registers concern with the large positive retrospective pattern in the recommended model and suggests that further investigation of this be a very high priority. (January 2020)

Issues with the retrospective pattern are addressed with the author’s recommended model, changing the Mohn’s rho value from 0.51 to -0.123.

# References

Williams, B., Hulson, P.-J., Lunsford, C. and Ferriss, B. (2022) Assessment of the dusky rockfish stock in the Gulf of Alaska. In: *Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska*. North Pacific Fishery Management Council, Anchorage, AK.

# Figures

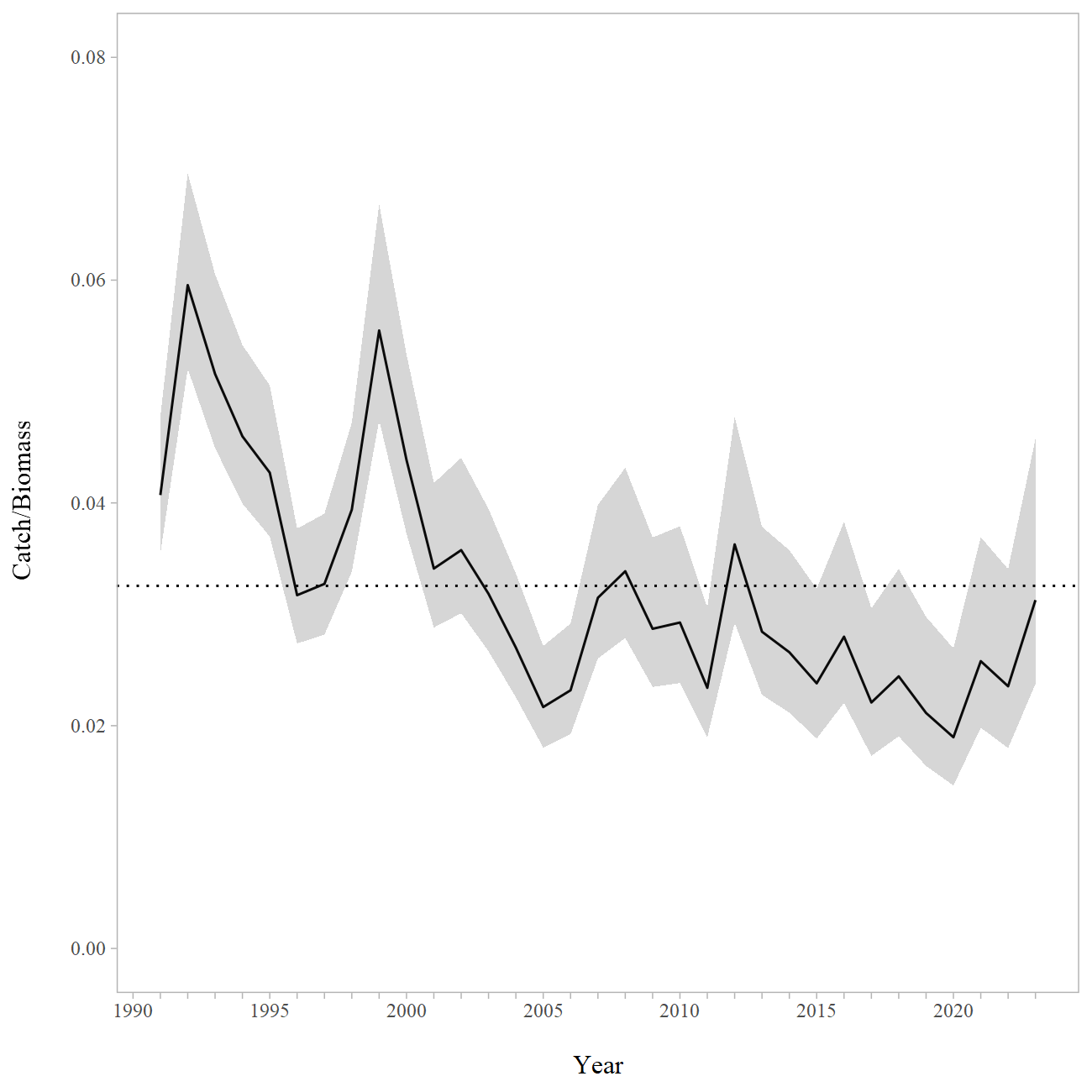


Figure 12-1. Gulf of Alaska dusky rockfish catch/age 4+ biomass ratio with approximate 95% confidence intervals. Observed catch values were used for 1991-2022, the 2023 catch values were estimated using an expansion factor. The horizontal dashed line is the mean value for the entire dataset.

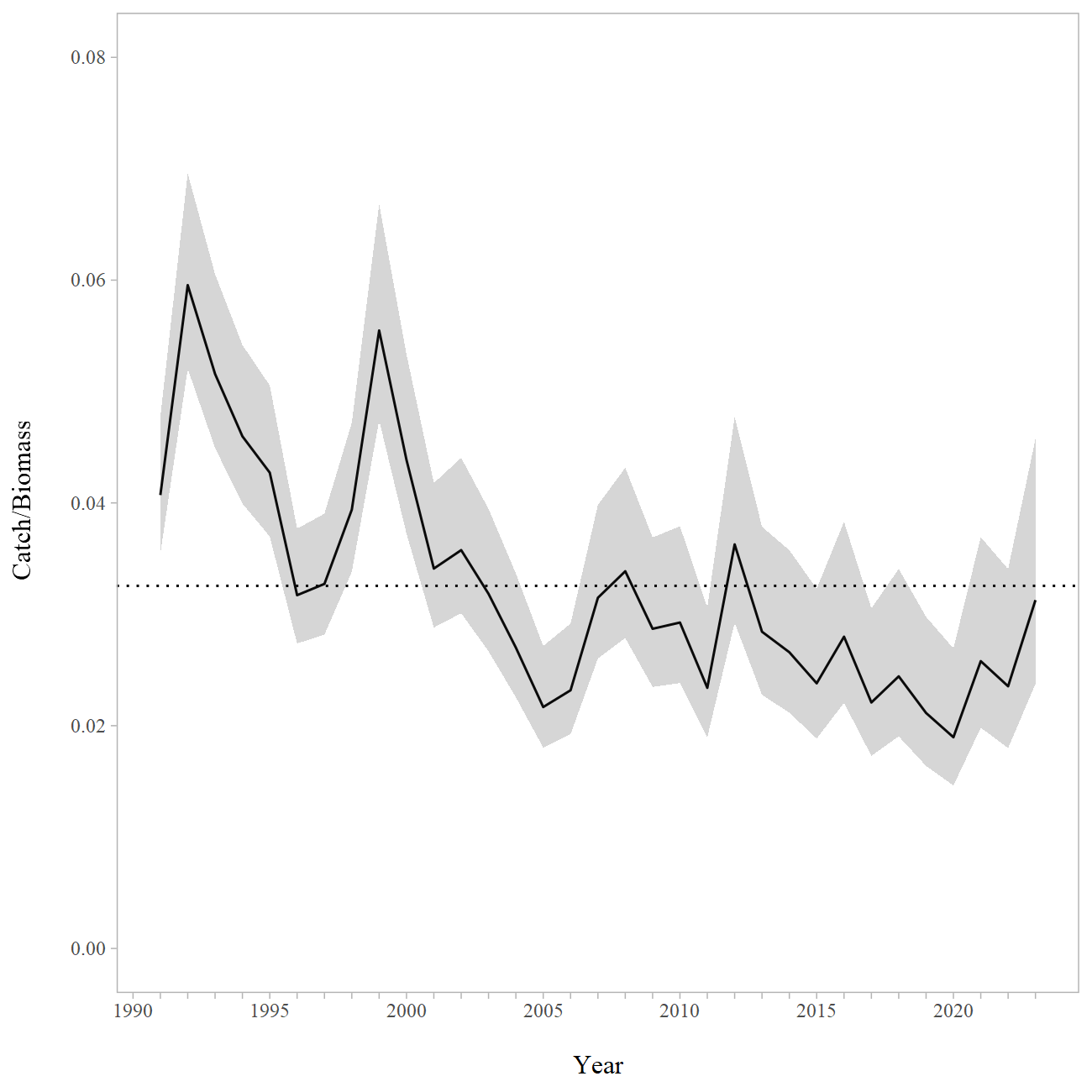


Figure 12-2. Geostatistical model (VAST) and design-based model estimates of trawl survey abundance for dusky rockfish in the Gulf of Alaska. Shaded areas are 95% confidence intervals, the dashed lines are the data means.